

REAL TIME CONTROL OF THE ACTIVE MHD DIAGNOSTIC ON ALCATOR C-MOD

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An Active MHD Diagnostic has been installed and operated on Alcator C-Mod. The diagnostic consists of two antennas and two broadband amplifiers. It can excite stable modes in the Toroidal Alfvén Eigenmode (TAE) frequency range. The antennas are located at a single toroidal location, one above and one below the outboard midplane. Each antenna is a 5-turn rectangular coil (15 x 25 centimeters) with a nominal inductance of 9 microhenries and a nominal resistance of 1 ohm. The Active MHD amplifiers are digitally-controlled, programmable current sources, designed to drive ± 20 A sinusoidal currents in the antennas at frequencies from a few kHz to 1 MHz. The amplifiers can drive the antennas directly at low frequencies, up to 80 kHz. A matching network, consisting of a series capacitor, is required at higher frequencies.

The original configuration of the Active MHD diagnostic imposed some severe operational limitations:

1. The matching networks between the amplifiers and the antennas had to be set manually. This limited the frequency coverage to a single 100 kHz band during a plasma shot.
2. The MHD output frequency had to be preprogrammed, based on expected plasma parameters.

Both of these issues have been addressed. We have added additional capacitors and switches to extend the high frequency tuning range from 180 kHz to 1 MHz. We have also made provisions for automatic adjustment. We also hope to improve the performance of the Active MHD diagnostic using the capabilities of the new C-Mod Digital Plasma Control System (DPCS). The DPCS will measure the appropriate plasma parameters and calculate the expected TAE frequency in real time. It will generate an analog signal corresponding to a frequency ramp centered around the calculated value. The new Active MHD Waveform Generator will use the DPCS signal to synthesize the required digital control signals for the amplifiers.